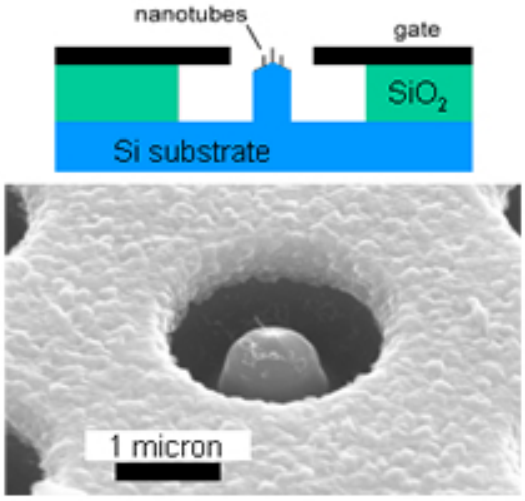
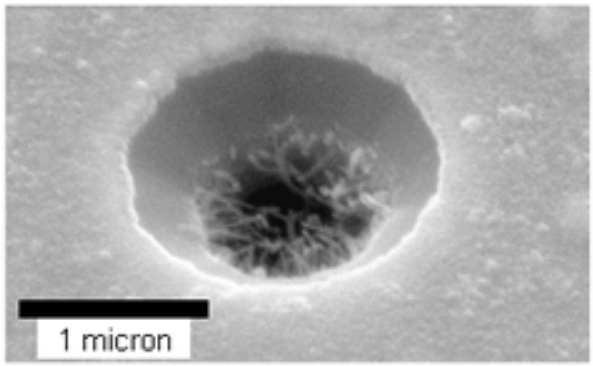
TRIODE CARBON NANOTUBE ELECTRON SOURCES





The Naval Research Laboratory has developed field emitter arrays (FEAs) based on integrally gated carbon nanotubes (cNTs). Electrons are produced via field emission from in-situ grown cNTs on microfabricated gated post structures (above left) or in gated open apertures (above right). Very low operating voltages, chemically stable cNT surface, and lack of electrical arcing make these more robust than conventional FEAs.

Advantages/Features Include:

- Operating voltages 3X lower than conventional FEAs (20-60V versus 70-150V
- Very low gate current (<2.5% anode current)
- Highly stable emission; no electrical arcing Maximum current density comparable to or greater than conventional FEAs
- Maximum current density comparable to or greater than conventional FEAs
- Insensitive to dulling by ions compared to conical designs
- Low capacitance due to arbitrarily tall base (i.e. post) structure
- Emission increases (> 10x) with exposure to water vapor, hydrogen, or high temperature
- Fewer processing steps = reduced fabrication costs

Applications Include:

- Flat panel displays
- X-ray generation (especially suited for miniaturization)
- High voltage power grid switches and high temperature electronics
- High frequency amplifiers
- Mass spectrometers (especially suited for miniaturization)
- Multi-beam electron lithography
- Satellite propulsion and charge neutralization
- Cold electron sources with low input power requirements

Points of Contact

Naval Research Laboratory
4555 Overlook Avenue, SW, Washington, DC 20375-5320

Jane F. Kuhl • Head, Technology Transfer Office • (202) 767-3083 • kuhl@utopia.nrl.navy.mil
Eric Snow • Electronics Science and Technology Division • (202) 767-3261 • snow@bloch.nrl.navy.mil